"Morphometric analysis for microlevel watershed management using remote sensing and GIS techniques : A case study of Upper Manar river basin"

A Synopsis

Submitted to

Swami Ramanand Teerth Marathwada University, Nanded

For the degree of

Doctor of Philosophy

In

Geography

Under the Faculty of

Humanities

By

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Research Guide

Shivneri Mahavidyalaya,

Shirur Anantpal, Dist. Latur

November 2019

1.0 Introduction

Water is a very important natural resource .Which is essential for life on the earth. As per rising in population, urbanization, Industrialization and agriculture area, Which puts the pressure on environment and eco-system it resulting in steep inclination of water demand line. To address such kind of issues collaborative , long-term and strategic agricultural management planning become necessary. With this support have it's own importants of pro active management approaches. This leads us to get the result in the form of increased operational efficiency and risk reduction. This study will trying to determine the area for the agricultural water planning and implementation. Such models will help us to develop better water management techniques into a proper planning. The parameters like geology, slope, drainage density, geomorphic units, lineament density etc. will be studying for the identification of the ground water potential zone.

Drainage basin analysis is very important aspect for the better understanding of the hydrogeology system. For this, the basin Morphometric characteristic has been studied by the various scientists (Rao et al, 2010 ; Rawat et al, 2011; Nag and Lahiri, (2011). Morphomeric analysis is a significant tool for prioritization of micro watersheds without considerated of soil map (Thakkar and dhiman, 2007)

Morphometric analysis requires measurement of the linear features, gradient and channel network contributing ground slope of the drainage basin. Many works have been reported a morphometric analysis using sensing and GIS techniques (Jamkar and Bhamre, 1983; Balaselvakunar and Kumarswamy, 2000; Thakkar and Dhiman, 2007 and Chavare, 2011). While the study of Morphometric analysis, it is necessary to understand the topography, erosion status and drainage pattern of the region (Sreedevi et al, 2000; and Kale and Gupte, 1986).

Morphometric analysis is the measurement of the earth's configuration such as surface, shape, and dimension and its landforms (Diwan and Gupte, 2004; and Lakshmamma et al, 2011). The drainage basin analysis is very essential in any type of hydrogeological investigation like the assessment of groundwater potential, groundwater management, pedology and environment assessment. Hydro grologist and Geomorohologists have recognized that certain relation are most important between renoff characteristics and drainage basin system (Essien and Okon, 2011).

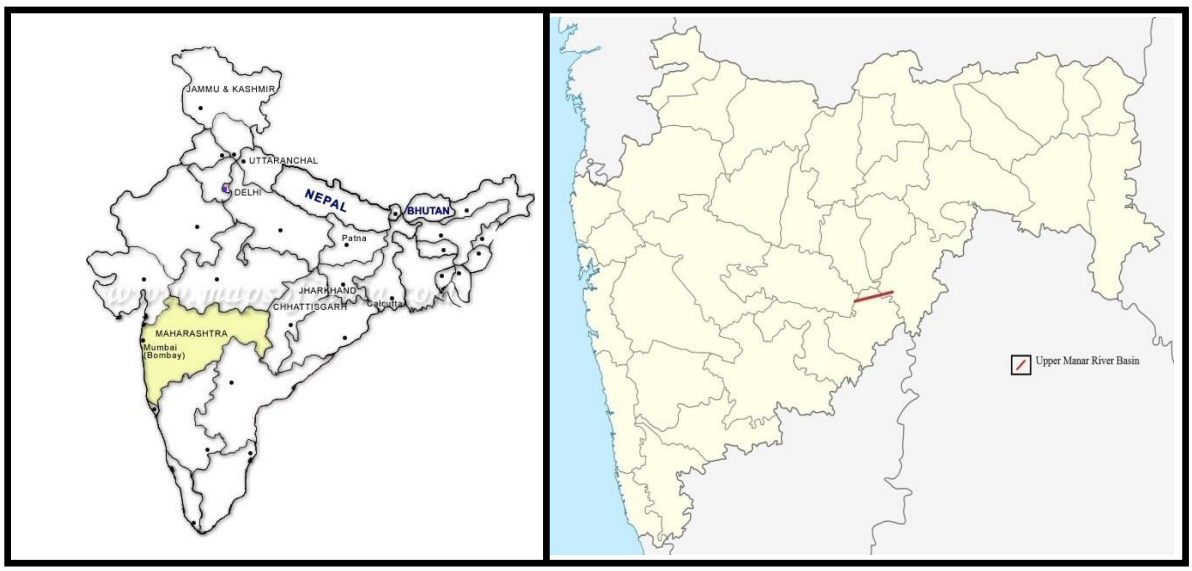
Various important hydrogeological phenomena can be correlated with the hydrographic characteristics of drainage basin such as size, shape and slope of drainage area, drainage density size and length of the tributaries. The quantitative analysis of drainage system is an important aspect of characteristics (Mahadevswamy et al, 2011). Drainage pattern refers to special relationship among the stream or rivers, which may be influenced in their erosion by in equal of shape.

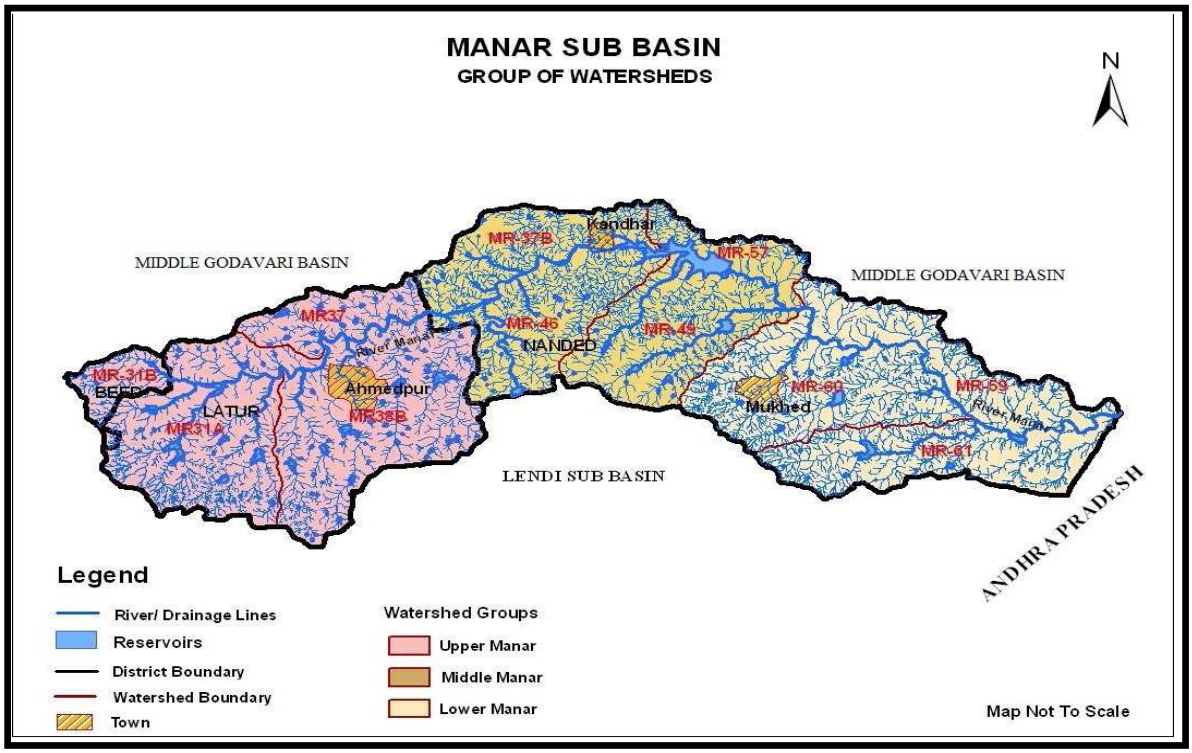
1.1 Significance of the study

The findings of the research will provide valuable insights and basic information to the students, geographers, agronomists, planners, governmental and non-governmental agencies and local administration in planning and management of water resources for storage, utilization and improvement for agricultural use. This agro-climatic study has therefore multilayered significance

1.2 Study area : - The Manar river is a main tributary of Manjra river in Maharashtra. It originates from near the Dharmapuri village of Parli Tahsil in Beed District. It enters in Latur District in North westerly direction and flows through Ahmedpur Tahsil area. After that it enters in Nanded District near Sangavi Sunegaon & flows through the Kandhar, Mukhed, Naigaon & Degloor Tahsil respectively. Finally it merges with the Manjra river near Shevala village of Degloor Tahsil. The main feature of the river is it originates in the Marathwada region and it also ends in the Marathwada region of Maharashtra state.

The present study area is Upper Manar river basin. The latitudinal extent of the study area is 18^0 30’ 28” to 18^0 50’ 20” North and longitudinal extent is 76^0 26’ 34” to 77^0 10’ 20” East. The total length of study area is approximately 47 km. It starts from near the Dharmapuri Village of Beed District and ends near the Limboti Village of Nanded District.


JAMMU & KASHMIR
UTTARANCHAL
DELHI
NEPAL
BHUTAN
Patna
JHARKHAND
CHHATTISGARH
MAHARASHTRA
Mumbai (Bombay)
Upper Manar River Basin


MANAR SUB BASIN
GROUP OF WATERSHEDS
N
MIDDLE GODAVARI BASIN
MIDDLE GODAVARI BASIN
Kandhar
MR-37B
MR-57
MR37
MR-46
NANDED
MR-49
River Manar
MR-31B
BEED
LATUR
MR31A
Ahmedpur
MR38B
MR-60
Mukhed
MR-59
River Manar
MR-61
LENDI SUB BASIN
ANDHRA PRADESH
Legend
River/ Drainage Lines
Reservoirs
District Boundary
Watershed Boundary
Town
Watershed Groups
Upper Manar
Middle Manar
Lower Manar
Map Not To Scale

1.3 Objectives of the study :

1) To study the geographical profile of the upper Manar river basin

2) To study drainage network characteristics of upper Manar river basin.

3) To study the drainage morphometry of the upper Manar river basin.

4) To study the channel bed sediment in upper Manar river basin.

5) To Find out the water budget of the study area.

6) To identify various Land uses and Land cover in the basin area.

7) To identify various micro level sites for the watershed development program in the basin area.

1.4 Review of Literature

It is required to refer secondary valid research document for any investigation. Such literature helps to build up the proposed work many investigation methods, ways, techniques, application provides new sight to the investigator. Therefore referred and listed some related secondary material in the present work has been discussed here. The highly concerned references and their views are categorised into some parts as below.

1.4.1 Geomorphology and Drainage characteristics

Rao and Reddy (1991), Suresh (2001), John (2001), Blott, Simon et al (2008), Farisand Reddy 2007), Jat et al (2007). Lvica (2008), Rao et al (2011) Chavare (2011), Vandana (2012) , Kartic and Bandypopadhay (2013), Aravinda and Balakrishna (2013), Choudhari et al (2014), Dhawaskar (2015) have individually focused parameters like stream order, stream length ratio, relief ratio, drainage density, stream frequency, circularity ratio, elongation ratio, drainage intensity, basin shape, drainage texture, gradient ratio, perimeter and texture ratio etc. in their work.

Chandrashekhar and Naganna (1983) has stated that the role of runoff water along weathering and mass wasting is main in case of morphology of river basin.

Kumar (1986) has opined that the physical factors like, topography , geology, hydrologic and lithological factors are connected to the drainage basin characteristics. It is always beneficial to find out the basic factors, which are part of the basin.

Pareta (2011), have opined that the study of morphometric and drainage characteristics is useful for planning of rainwater harvesting and watershed management.

Mishra et al (2011) have stated that morphometric parameters are useful for providing valuable information about groundwater and its condition.

Zande and Nagrajan (2011), have studied about the natural water resources management in their study. They applied study of drainage morphology for analyzing the sub watershed in Krishna River basin.

According to Chavare (2011), morphometric parameter like drainage density, steam frequency and bifurcation ratio plays a significant role for water resource management and assessment of soil erosion.

Nag and Lahiri (2011), have stated that morphometric analysis has great necessity in the evolution of river basin, watershed analysis for soil and water conservation and natural resource management.

Uniyal et al (2013) has studies the various watershed management and morphometric parameter by usuing various technologies. They concluded that the morphometric analysis is an applicable tools for micro level watershed management.

Hajam et al (2013) has told that the morphometric analysis of the drainage basin and channel network performance have an important role to understand the geo-hydrological, geology, and geomorphological activities of drainage basin. This all aspects useful for micro level watershed management.

Srivastava et al (2014) has stated that the morphometric analysis based on GIS techniques, is mostly useful to study the fundamental geo hydrological features and natural watershed planning and its management.

1.4.2 Land use Land Cover

Many scholars they have worked on Land use and land cover with different angles. Viz. NRSA (1994), Dhaeseleer (1996), MAS (1999), Arthur (2000), Lopez et al (2001), James (2001), Herold et al (2005), Lung (2006), Oluseyl, (2006), Giridhar and Viswanath (2007), Arzu and Hafize (2009), Carison and Charles (2010), Gang et al (2012), Shinde (2012), Aktar (2013), and Karande and Khadke (2013).

According to Ramachandra and Kumar (2004), Land-cover refers to the physical characteristics of earth's surface, captured in the distribution of vegetation, water, soil and other physical features of the land, including those created solely by human activities e.g, settlements.

Chenetet et al. (2003) has stated that change in Land-use and changes for environment studies.

Sreenivasulu and Bhaskar (2010) have studied land use and land cover and its trend of change is essential for various reasons. Land use data is needed in the analysis of environmental processes and problems as a prime parameter.

Paria and Bhatt (2012) have studied about the change detection in land use and land cover for understanding and assessing anthropogenic activities on the land.

Daniel and Ayobami (2007) have studied land use/land cover (LULC) changes for tropical regions, which have major concern to the widespread and rapid changes in the distribution and characteristics of tropical forests.

According to Nagarale and Jadhav (2012), land use is the surface utilization of all developed and vacant land on a specific point at given time and space.

Ramachandra and Kumar (2004) have studied the changes detection, where they have been observed continuous changes in the same.

According to Gaud and Singh (2011), Land use is the surface utilization of all developed and vacant land on a specific point at a given time and space.

Shahapurkar and Gajre (2011) have stated that land use is an important aspect of geographical studies particularly relevant to agricultural geography.

Prakasam (2010) has stated that Land use and land cover is a fundamental factor for understanding the interctions of natural and human activities such types studies are necessary to be simulate changes.

Prabhbir (2010) have studies Land use land cover changes detection and presented same maps and analyzed statistical data which has importance in spatial planning management and study of land.

Nasim (2013) and Rawat (2013) has studied the land use and land cover and geospatial techniques by using geographical information system and sensing approach.

1.4.3 Agriculture

Agriculture is an important human activity of their various natural resources, agricultutal aspects like cropping pattern, land utilization, crop diversification, crop intensity; agricultural productivity has also correlation with socio economic studies of the society many scholar like Ghodke (2009), Kankure (2009), Pawar (2010), Rede et al (2004), Bhalsing (2009), Kankure et al (2009), Patil (2012) , Masal et al (2011), Mandal (2012), etc have also been worked on the same line and thinking.

Vyalij (2009), concluded that, change in cropping pattern is influenced by the physical, cultural and socio-economic aspects.

According Shimpale (2012) for the development of irrigation more agriculutral productivity, high yield of crop use of pesticides and chemicalfertilizers etc. The indepth studies are necessory and forcefully applied there resents.

Rede (2012), worked on the impact of agro climatic change on cropping pattern and agricultural production. However apply the new technologies of irrigation may helps to changes the cropping pattern.

Ghodke (2009) studied an various crops combination and its impact on socio economic aspects and change in cropping patterns. He said that the study of crop combination will be helpful for sustainable agricultural management and increasing the high productivity, yield and quality of agricultural products.

1.4.4 Watershed Management

Twumasi (2006), has studied that the remote sensing technique to provide basic information about the surrounding ecology and ecosystem of watershed area.

Johnson J (2013) has stated that the watershed management's tools are needful for irrigation potential as well as to increasing agricultural productivity. Watershed is important for ground water management.

Sadgir et al (2006) has studies about contour trenching technology for sustainable watershed management. They also concluded the contour trenching techniques is modern technology for runoff water management.

Dharmesh (2006) has suggested the type's of artificial water recharge methods for planning and designing of watershed management.

1.5 Approach

The present study will be carry by adopting micro level approach meaning. The basic data will be collect mainly from survey, observation and little bit from secondary sources. The investigation will be try to carry out feasibility and site suitable of watershed management tools for sustainable agriculture water resources. In short, the present investigation is based on multidisciplinary approaches.

1.6 Research Techniques and Methodology

The advance techniques like GIS mapping and computerized tools for data analysis shall quite useful for preparing the database and presentation. Various thematic maps like physical, climatologycally, topographical, agri-climatic cropping pattern etc will be collect data from various governmental, nongovernmental and field works at micro level.

The present study related to geomorphology, land use land cover, irrigation, agricultural setup, natural water resources and sustainable agricultural water resource management, data source and data collection, second is data analysis and third one is data presentation.

1.6.1 Data Base : Source and collection

For the micro level study two types of data will be use,one is primary and second one is secondary data.

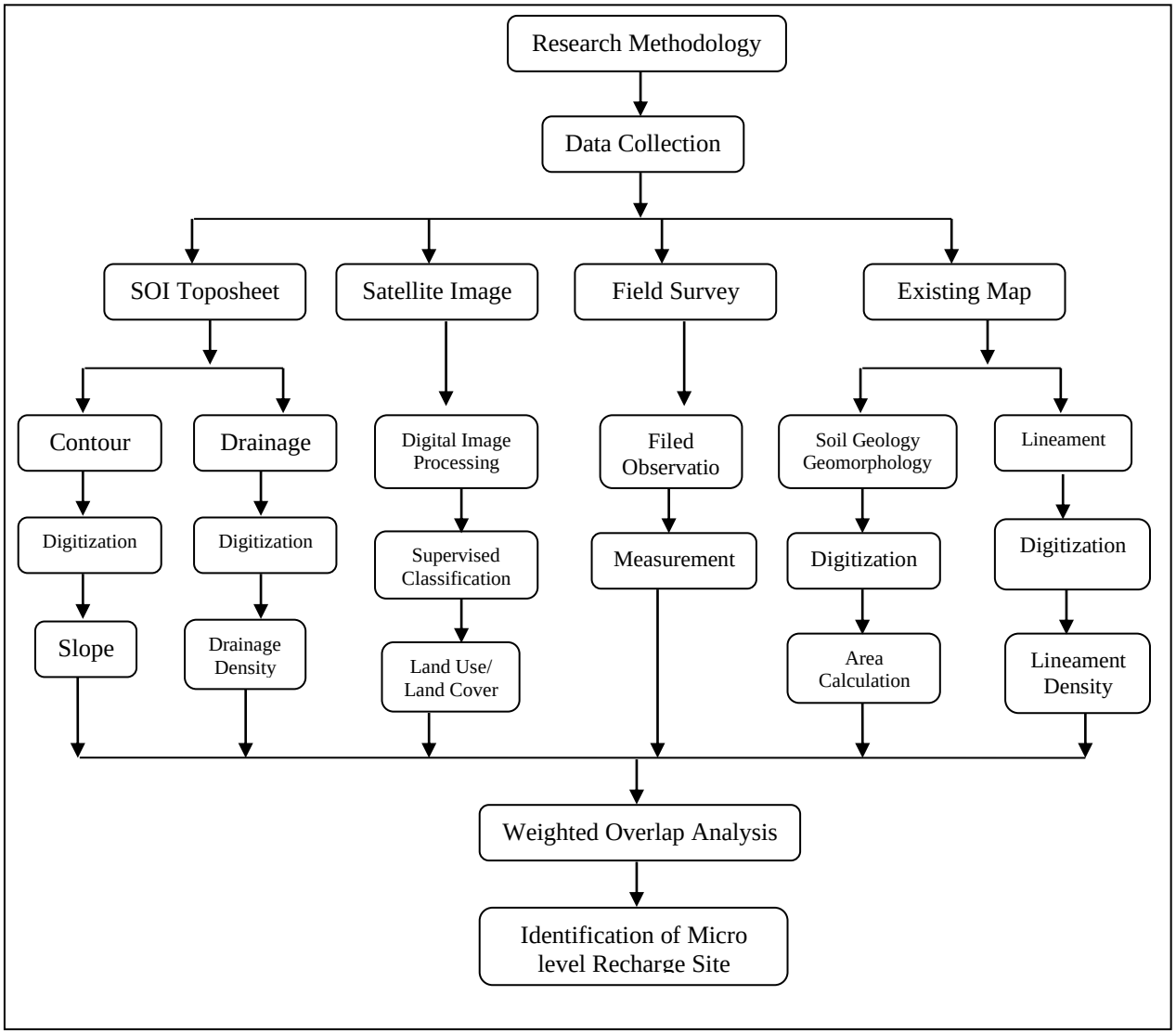
a) Primary Data

For further investigation, primary data will be collect from field surveys, lab work and field observation like drainage characteristics, natural water recourses, storage capacity, location, calculated runoff water, change in land use and land cover, change in cropping pattern, change in irrigation and water availability for agricultural. The collected data will analyse with suitable methods.

b) Secondary Data

Secondary data will be collect from government and non-government offices and institute, like rainfall temperature, irrigation facility and total area, land use land cover primary data, SOI toposheet, basic maps, soil, large scale dam and small scale dam location and there storage capacity also collect from second hand.

Figure : Flow Chart of Methodoloy



1.6.2 Data Analysis

For the proper analysis of available primary and secondary data evaluation therefore uses various computer software and tools will utilize like open source GIS software and other statistical tools.

1.6.3 Geographical Information System

Role of GIS in this study mainly using for calculate length, area under water bodies, land use and land cover and change deduction, irrigated area calculation, measurement of basin area etc.

1.6.4 Remote Sensing

Romote sensing technique mainly use for understanding of the change in land use of study area. Landsat 23.5 meter and landsat 30 meter resolution image will be use for the micro level study. All the landsat images will collect from Global Land Cover Facility (GLCF) and Bhuvan National Remote Sensing Centre.

1.6.5 Land use and Land Cover (LULC)

Land use and land Cover analysis is a process of land management which is utilized by agricultural land, settlement, cultural waste and dry land. Land cover is the physical aspects and other components on earth like forest, physiographic, water bodies etc. Land use is the main factor for water recourse management.

1.6.6 Water resources and irrigation

Management of agriculture water, it is the main component. For this the rainfall, actual available water and run off will be calculate. Natural water storage like dam, irrigation projects and their storage capacity, command area, water use and other prospective have also assess.

1.6.7 Morphometric parameter

Various morphometric parameters such as linear aspects of the drainage network, viz. stream order, bifurcation ratio, stream length and areal aspects of the drainage basin, viz. drainage density, stream frequency, texture ratio, circularity ratio, from factor basin etc. will be calculate.

1.6.8 Field surveys

This is an indispensable component of geographic investigation. It is a basic technique to understand the earth. It will concede out through observation, sketching and measurement. In the present investigation therefore use of field surveys for site suitability for artificial water recharge will be mainly focuse.

1.7 Arrangement of Text

The present study entitled **"Morphometric analysis for microlevel watershed management using remote sensing and GIS techniques : A case Study of Upper Manar river basin"**, which including following chapter scheme.

1.7.1 Chapter I : Introduction

Chapter first arrange with an importance of the theme selected for present investigation. The objectives, database, methodology, brief review of literature and choice of the study region are also included in the chapter.

1.7.2 Chapter II : Geographical Profile of Study Area

Chapter second seeks to present the geographical background of the study region, followed by the study physical and meteorological setup, soil type, population etc.

1.7.3. Chapter III : Geomorphological Features

The analysis of morphometric analysis of study area like, stream order, stream density, stream frequency, basin area, bifurcation area and other main parameter analysed in the third chapter. The chapter mainly set up with geomorphology drainage characteristics.

1.7.4 Chapter IV : Climate and Water Resources

Whereas chapter four deals with climate and present water resource in study area. Therefore it will be calculate runoff water, ground water level, total irrigation, to find out the large and scale irrigation dam, sours of irrigation, change in irrigation and types of present irrigation.

1.7.5 Chapter V : Cropping Pattern and Land and Use Land Cover

Land use and land cover and agricultural setup of study area I will be study in the fifth chapter. Chapter deals with land use and land cover, change deduction, satellite image classification, change in cropping pattern, study the agricultural setup and productivity.

1.7.6 Chapter VI : Site selection for Micro level watershed development

The chapter deals with site selection for sustainable agricultural developemnt in study area. Here also study watershed management tools and its need and feasibility

1.7.7 Chapter VII : Result and Discussion

The last chapter attempt the result of overall study with discussion and lastly, concluding remark of the study.

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